Space Weather Technical Forecast

Issued on Wednesday, 19 October 2022 at 13:05 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant activity

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with a few low level C-class flares mostly originating from AR3124 Dao/Beta which is now approaching the southwest limb of the visible disc. A further small, but developing Bxi/Beta region has emerged in the southeast disc, but remains unnumbered. There are two further small regions, AR3125 Axx/alpha in the southwest and a further unnumbered region in the southeast. No Earth directed CMEs were visible on available satellite imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1 continued to ease, as Earth transitions into a slow wind environment. Speeds fell 530 km/s to a slightly elevated level of 450 km/s. The density was near to below average. The total IMF strength, Bt, was weak below 6nT, with the north-south component, Bz, varying weakly between +5/-4 nT. The phi angle was mostly negative (towards the Sun) throughout. Geomagnetic activity was Quiet (Kp 1-2) throughout the period.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2MeV) at GOES-16 was at mainly Moderate levels, with a peak flux of 708 pfu recorded at 18/1645UTC. The associated fluence was below the Active (1e8 integrated pfu) threshold on a flat trend, with 3.3e7 integrated pfu observed at 19/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low or Very Low, with only a very slight chance of M-flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Current slightly elevated solar winds are expected to continue easing day 1 and 2 (19th and 20th). A slight enhancement is possible day 3 (21st) due to any residual fast wind from now closed CH33/+. A further enhancement is possible later day 4 (22nd) due to the arrival of the fast wind of CH34/-, although this is low confidence. Geomagnetic activity is expected to be mainly Quiet days 1 and 2 (19th-20th). There is a chance of Active intervals day 3 (23rd). There is chance of activity increasing to Unsettled to Active with slight chance of G1/Minor Storm intervals by the end of day 4 (22nd).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) is expected to be at background levels. High energy electron flux (greater than 2MeV) as observed by GOES-16 is expected to remain mainly at Background to Moderate levels, perhaps briefly High at diurnal peak. 24 hour Fluence levels are expected to remain the Active (1e8 integrated pfu) threshold.

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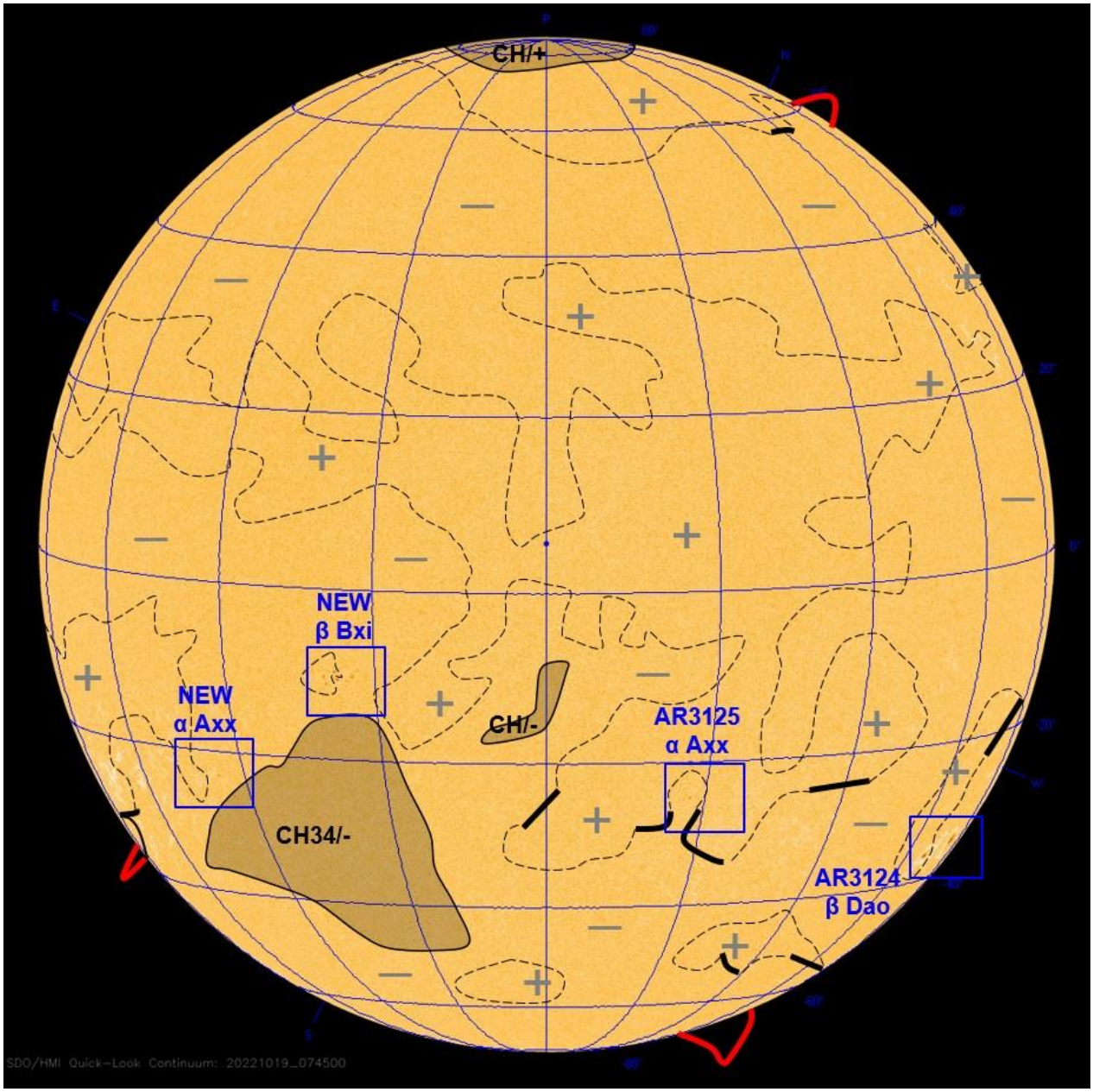
Figure 1. Solar Analysis Valid 19/0800.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs.

Solar winds are currently slightly elevated as the recent fast wind enhancement from CH32/- wanes, with Earth transitioning into a slow wind environment. Wind speeds are likely to fall to background levels before any potential enhancement from the small and closing coronal hole 33+. This coronal hole is much smaller than on the previous rotation, and is now impossible to see. However this was present in the central disc on the 17th, perhaps bringing a weak enhancement on day 3 (21st) with solar winds perhaps rising to around 450-500 km/s. Through day 4 (22nd), enlil suggests a significant enhancement arriving from either the larger southern disc hole CH34/-, or a newly opened small hole, in the southeast disc. This is low confidence, however as whilst the coronal hole is larger and more distinct on this rotation, solar wind persistence would suggest the arrival of any fast wind enhancement isn't expected until the 24th.

Geomagnetic activity is expected to be mainly Quiet day 1-2 (19th-20th). There is a chance of Active intervals day 3 (23rd). There is chance of activity increasing to Unsettled to Active with slight chance of G1/Minor Storm intervals by the end of day 4 (22nd).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	5	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2a: MOSWOC SWPM, showing potential weak enhancements on 20th and 21st, followed by stronger enhancement on 24th

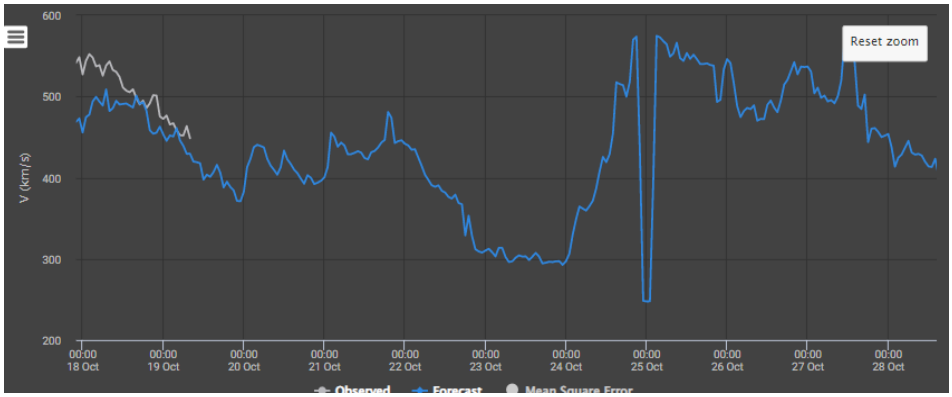

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Figure 2b: SDO aia-211 of last rotation (left) and current rotation (right), showing decreased size of CH33, and increased distinctiveness of CH34

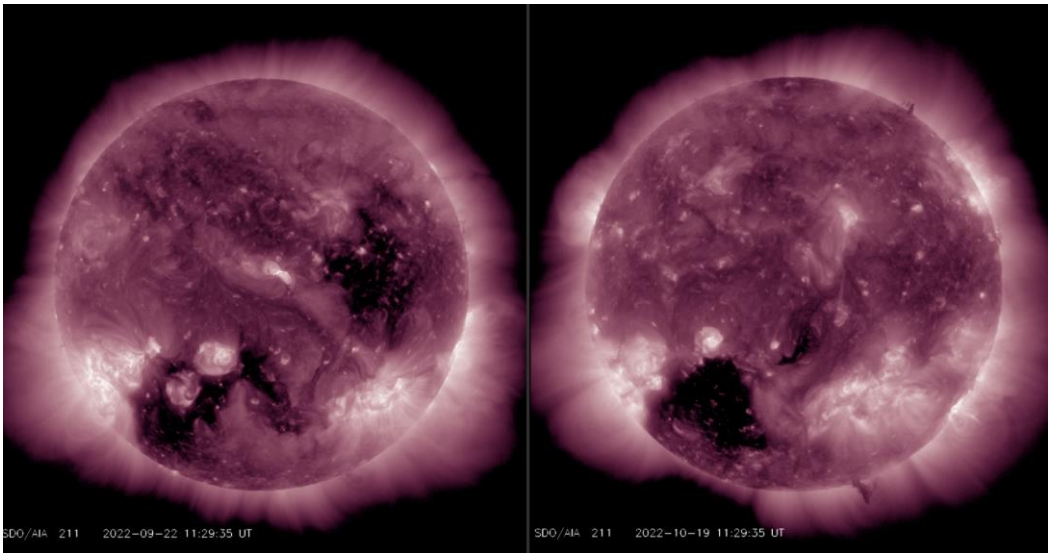
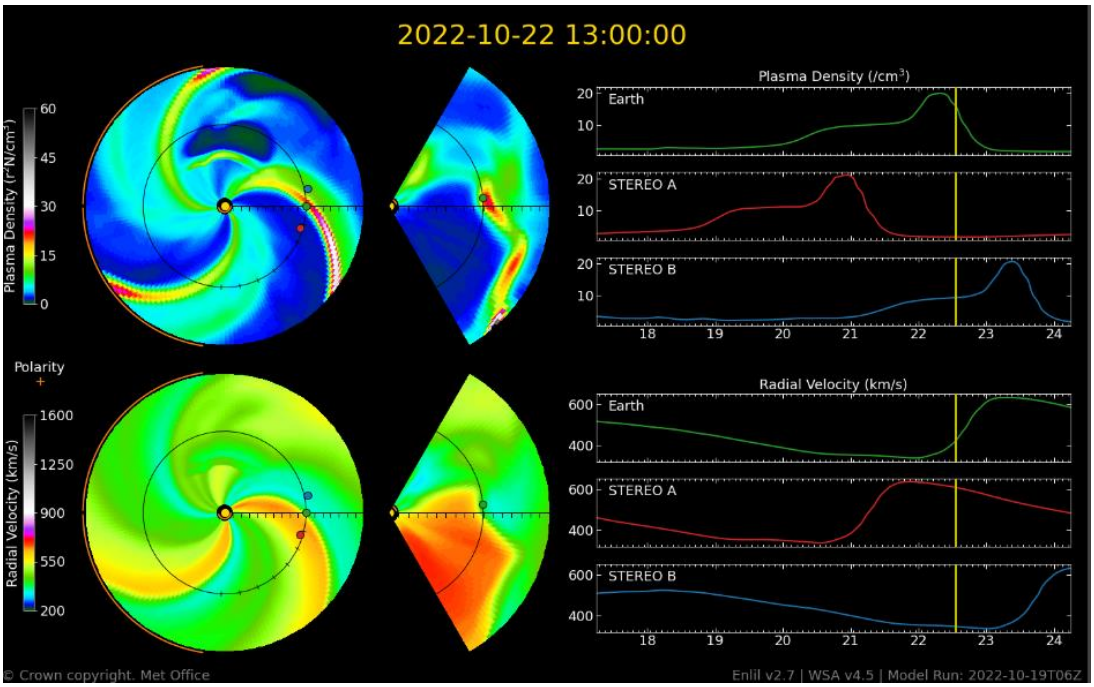


Figure 2c: Enlil showing notable enhancement on 22nd



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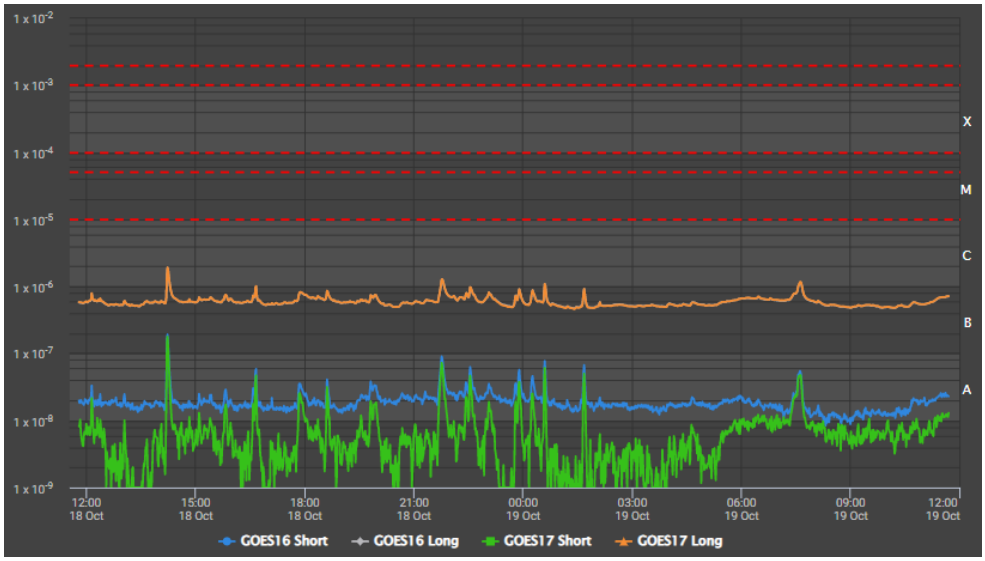
Radio Blackouts - X-Ray Flares:

Solar Activity is currently Low, with only small C-flares at times, mainly from AR3124 Dao/Beta near the southeast limb. Activity is expected to remain Low, perhaps falling to very Low. This sunspot will rotate off the disc by the end of day 2 (20th), however a slight chance of M-flares is maintained throughout with newly developing sunspot Bxi/Beta in the southwest. The other two regions on the disc remains small and simple.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-16/17 X-ray Flux



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES16 is currently at background levels and is expected to remain at this level.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES-16 has exhibited a diurnal variation between Low and High to Moderate levels on a day-by-day basis. Solar winds have now eased to slightly elevated levels, with no notable increase in electron flux levels as the Van Allen Belts relax back to GEO. Peak flux levels are not expected to significantly rise again until beyond this period, and likely becoming suppressed to background due to any fast wind arrivals of CH33/+ and CH34/- on days 3 and 4 (21st and 22nd).

The associated 24 hour electron fluence is expected to remain below the Active threshold (1e8), in agreement with REFM, which is currently giving good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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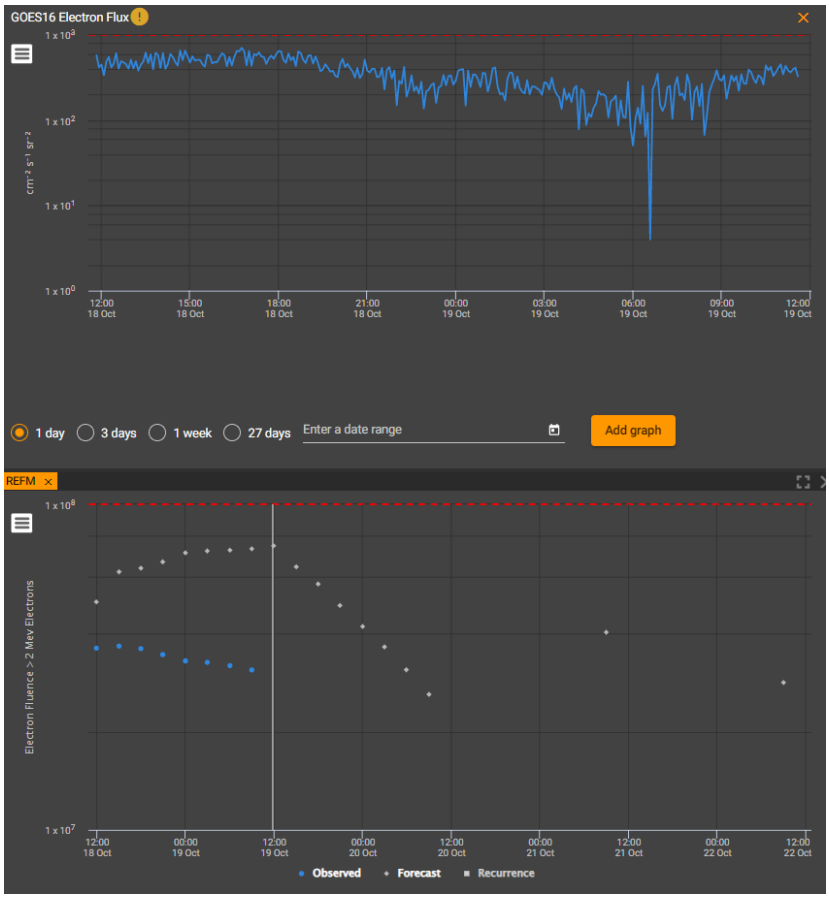
Figure 4: GOES-16 >2 MeV Electron Flux and Fluence with associated REFM



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